Development of an in-vivo Sensing Technology for Cancer Signature

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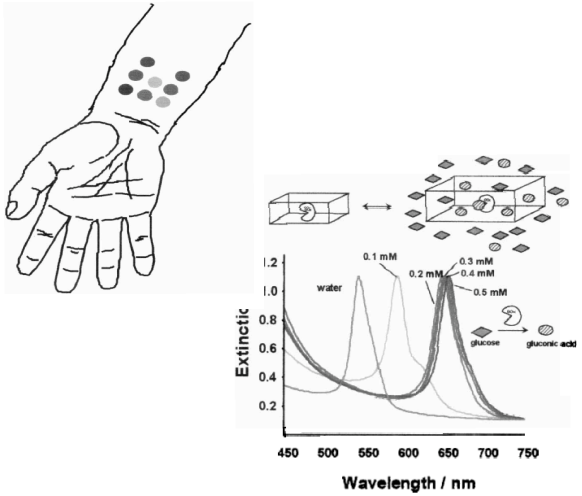
Biomolecular Systems Research Program

Figure 3.

Implanted IPCCA array to sense protein signatures of cancer and other clinically important analytes.



Description

This research and development program is highly interdisciplinary and utilizes the most recent advances in physics, chemistry, biology and nanoscience. The research utilizes:

1. Novel molecular recognition chemistries, materials, chemical composites, nanoparticles, nanostructures, agents and devices suitable for *in vivo* use".

2. Novel strategies for *in vivo* signal generation."

3. New approaches and multifunctional technology platforms to create an interface between *in vivo* detection and targeted intervention, including nanostructures/devices and novel materials and composites."

Innovative Claims/NASA Significance

Our research and development program will create a biomolecular sensor technology platform to enable non-invasive or minimally invasive early detection of signatures of disease, especially cancer. We will utilize our recently invented intelligent polymerized crystalline colloidal array (IPCCA) material^"^ for ***in*** *vivo* sensing. These IPCCA materials and devices utilize novel molecular recognition chemistries within materials containing periodic nanostructures of composite nanoparticles"". The signal generation utilizes diffraction of incident light by the nanoparticle arrays'-338. This diffraction of light serves as the interface between ***in*** *vivo* detection and targeted intervention. This technology platform can be multifunctional, in that different PCCA sensors for different disease signatures can be fabricated by utilizing different molecular recognition elements in these biocompatible PCCA materials.

Plans

Milestones

Each of the entries in the Statement of Work above constitute milestones in the proposed research program. These milestones are:

Year 1
1 Attach PSA to IPCCA
2 Attach BLCA-4 to PCCA
3 Demonstrate IPCCA response to PSA and BLCA-4 in saline
4 Optimize sensors

Year 2
5a Test IPCCA PSA sensor in fetal calf serum
5b Test IPCCA PSA sensor with plasma from prostate cancer patients
6a Test PCCA BLCA-4 sensor in fetal calf serum
6b Test PCCA BLCA-4 sensor with urine from bladder cancer patients
7 Refine sensors for implantation
8 Implant PCCA beneath skin of mice and rats to determine biocompatibility
9 Determine visibility of diffraction fi-om implanted IPCCA

Year 3
10 Construct reflectometer
11 Fabricate near IR PCCA sensor for implantation
12 Demonstrate *in vivo* sensing by implanted PCCA to protein signatures of cancer